Source Water Assessment for Pascoag
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I. Introduction

The Source Water Assessment Program, or SWAP, was established by the 1996 Amendments to the federal Safe Drinking Water Act (SDWA), specifically by the addition of Section 1453 of that Act. Its stated purpose is to assess the threats to sources of public drinking water, "for the protection and benefit of public water systems, and to support monitoring flexibility". Its funding comes from a $1.2 million set-aside from the Drinking Water State Revolving Fund. In Rhode Island, the Office of Drinking Water Quality in the Department of Health (HEALTH) is responsible for producing these assessments, and will provide them to suppliers, municipal officials, and the general public.

It is generally accepted that it is cheaper to protect water from contamination than to treat the water or find new sources. The intent of the Source Water Assessments is to inform suppliers, town and state officials, and consumers of public waters of the threats to their water quality, and enable them to take appropriate action to protect their water. The first intended benefit is the information itself, along with the public awareness and support for protection that we hope will result from the process. The second benefit is the stated intent of the law, which is to support monitoring flexibility. If a particular contaminant is not present in a Protection Area, and has never been detected in the water, then a monitoring waiver can be granted. This has the potential of saving a system hundreds of dollars per year in testing fees.

There are four basic requirements of the SWAP:

The first step is to identify the land area that contributes water to the source. This has been done for public wells, including Pascoag's wells, under DEM's Wellhead Protection Program, based on various hydrogeologic methods.

The second step is to inventory all potential sources of contamination to the water supply within the SWPA. These are land uses that use, store, or generate chemicals or microbes that are considered risks to human health, and may include everything from industries and agriculture to residences and wildlife. Under the SWAP, existing land-use information has been updated and field-verified by a group of citizen-volunteers, trained under the RI Home*A*Syst program.

The third step is to assess the overall susceptibility of the supply to contamination, and to estimate the risk associated with each potential source of contamination. This is being done in close cooperation with URI's Cooperative Extension Service, with extensive use of Geographic Information System (GIS) technology.

The last step is to make the results of the assessments known to the suppliers and consumers of public water, as well as to town planners, developers and others with an interest in the long-term quality of our drinking water supplies.

PASCOAG WATER AND FIRE DISTRICT is a Community water supplier in the town of Burrillville. It has approximately 1000 service connections, and a total population served of about 3500 persons. Most of the protection area is sewered, but storm drains are not connected to the sewers, so all storm water (and any accidental spills) goes to the aquifer.

WELL CHARACTERISTICS: The last sanitary survey was performed on 4/12/2000. Well locations were corrected from photo-interpretation based on that survey. Most of the following information was obtained from the RI HEALTH water systems files.

Well #1 has been **physically disconnected from the water supply, but has not been formally abandoned** (HEALTH Sanitary Survey, 04/2000). Wells that are not properly sealed can form a conduit to the aquifer for whatever contaminants may be in the area. For this reason, it is suggested that unused wells be formally abandoned and permanently closed.

Well #2 (01): **As of 4/2000, this well is not in use; however, it has not been formally abandoned.** "Well #2 was constructed by R. E. Chapman Company and put into service in 1947. The well is situated roughly 630 feet south of the floodplain of the Clear River. This well was redeveloped in March of 1989 and currently has a safe yield of 125 gpm. The 18" by 12" gravel packed well is 41 feet in depth. The Everdur screen is 12 inches in diameter and 10 feet in length. The wellhead is 18 inches above grade. The #2 pump station houses a Crane Deming vertical turbine pump with a production capacity of 125 gpm at 285 feet above head. The pump is powered by a 15 HP US Motors electric motor. The pump draws suction from a 12 inch diameter, 31 foot long casing and discharges from a 6 inch discharge head". This pump has been removed, as of 4/2000. The raw water from this well is disinfected with 11 percent hypochlorite solution applied using a single, Liquid Metronics metering pump with a maximum output of 38.5 gpd. Well #2's design production is estimated to be 125 gpm.

Well #3 (02) "is the primary ground water supply for the Pascoag Fire District. This well is situated roughly 300 feet southwest of Well #2. The gravel-packed well was constructed in 1970, approved in 1971 and put on line in 1971. According to a study done by Dufresne-Henry in July of 1988, Well #3 is the Pascoag Fire District's main source of supply with an estimated safe yield of 700 gpm. The depth of this well beneath the pump station floor is approximately 57 feet. The length of the stainless steel screen is eight feet with a diameter of eight inches. The well casing is eight inches in diameter and fifty-one feet in length. This well's pump station houses a Crane Deming, Vertical Turbine pump, driven by a 50 HP US Motors electric motor. The pump has a rated capacity of 450 gpm at 250 feet TDH.

The raw water from Well #3 is disinfected with 11 percent hypochlorite solution applied using a single, Liquid Metronics metering pump with a maximum output of 38.5 gpd (Pascoag Fire District 2/96). The potable water supply is stored in a 28 foot diameter, 58 foot tall steel standpipe located off of Route 100 heading south out of Pascoag. The standpipe has a storage capacity of 0.265 million gallons. Well #3's design production is 450 gpm. Distribution piping consists of lead, AC / UV pipe, copper, and plastic.

Well #3A is in the process of being approved as a gravel-packed well. It is 64' deep and finished in bedrock, but the water appears to be coming from the gravel stratum above. Its design production is 800 gallons per minute.

B. Sampling History:

Nitrate levels in mg/l, over the past four years, are as follows: **Well #2 (01):** ND (no detection), ND, 0.1, ND; **Well #3 (02):** 1.2, 1.9, 1.5, 1.3
Other detections:
Well #2 had one detection of gross beta particles at 2.0 pCi/L, well below the Action Level of 50 pCi/L. Sodium was detected twice: 7.25 mg/L (1997) and 9.37 mg/L (1999).
Well #3 has had recurring high sodium levels: 27.9 (1996), 27.4 (1997), 37.9 (1998), 31.0 (1999), 34.0 (2000). There was one detection of gross alpha and beta particles (alpha 1.9 pCi/L, beta 3.0 pCi/L), well below the Action Level of 50 pCi/L. Barium was detected (1999) at 0.02 mg/L. See Pascoag's CCR for more details on recent detections.

In April 1996, testing for regulated SOCs was waived with the exception of Di(ethylhexyl)phthalate (Phase V, TO25) and PCBs (Phase II, PE18). Di(ethylhexyl)phthalate could not be waived due to the presence of a print shop located within the WHPA. PCBs could not be waived due to the presence of a PCB-containing electrical transformer burial ground in proximity to the wells.

The following SOC testing has occurred as of 6/14/2000 with no detections of any of the monitored analytes:
Well #2 (01): PE18 (2/24/96); PE18 (10/15/96); TO25 (9/23/96); TO25 (6/10/96); CT4 and PE17 (6/95); CT4 and PE17 (4/95); PE13 (10/94); PE4 and PE14 (10/94); PE17, CT3, and CT4 (10/94); PE1, PE4, CT3, CT4, PE17, PE13 and TO21 (7/94); TO21 and CT4 (6/94); PE14 and PE4 (6/94); PE13 5/94; CT2, CT3, CT4, TO21, PE14, and PE4 (3/94); PE1 and PE2 (1/91); and PE1 and PE2 (10/88).
Well #3 (02): PE18 (2/24/96); PE18 (10/15/96); TO25 (9/23/96); TO25 (6/10/96); CT4 and PE17 (6/95); CT4 and PE17 (4/95); PE13 (10/94); PE4 and PE14 (10/94); PE17, CT3, and CT4 (10/94); PE1, PE4, CT3, CT4, PE17, PE13 and TO21 (7/94); TO21 and CT3 (6/94); PE14 and PE4 (6/94); PE13 5/94; CT2, CT3, CT4, TO21, PE14, and PE4 (3/94); PE1 and PE2 (1/91); and PE1 and PE2 (10/88).

CONTAMINANTS/PROBLEMS: No violations have been issued as of 19 June 2000.

NEARBY PRIVATE WELL CONTAMINATION: Nothing found.

II. Vulnerability: Geology, Soils

A. Geology

TOPOGRAPHY/SLOPES/WATERSHED/WHPA: The Pascoag Fire District's WHPA is an irregular-shaped area consisting of approximately 158.2 acres. The long axis of the WHPA is oriented, generally, from south-southwest to north-northeast toward the well.

A short moderate to steeply dipping slope or bank just east of the wells dips toward the west and northwest toward the Pascoag River. In general, slopes within the WHPA dip toward the Pascoag River - to the east on the west side of the river and to the west on the east side of the river. Two small topographic depressions are located in close proximity to the wells. These depressions may have a seasonally high water table at or near the surface. The Pascoag water system is located within the Pascoag River Watershed. The Pascoag Fire District's WHPA is located within the Chepachet Topographic Quadrangle.

SURFACE WATER BODIES: The northern shore of the Pascoag Reservoir represents a portion of the southern boundary of the Pascoag Fire District's WHPA. Well #2 is located 3,625' north of the Pascoag Reservoir. Well #3 is located approximately 3,400' north of the Pascoag Reservoir. Well #2 is located approximately 1,050' east of the northerly flowing Pascoag River. Well #3 is located approximately 900' east of the river. Wetlands were identified along the west bank of the Pascoag River. The Clear River is located approximately 1,000' north of the wells and outside the WHPA.

GEOLOGY/AQUIFER CHARACTERISTICS: The Pascoag Fire District wells appear to have been completed near the contact of two bedrock units: the Late Proterozoic-aged, Esmond Igneous Suite, Augen Granite Gneiss (Zeag) and Granite Gneiss (Zegg). Both of these are associated with high fluoride levels (USGS Report #99-4160).

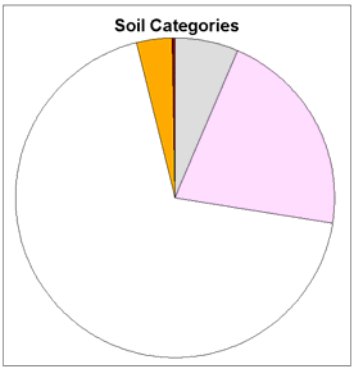
B. **SOIL CATEGORIES**

Soils have been classified by those factors which have been found to have an effect on movement of contaminants in the soil. Information on each soil type can be obtained from the Soil Survey of Rhode Island, published by the US Department of Agriculture Soil Conservation Service. For assessing the threats to drinking water, the following groups have been chosen:

1. A - Excessively Permeable
2. B - Well Drained
3. B - Seasonal High Water Table (SHWT), 1.5 Feet - 3.5 Feet
4. C - Seasonal High Water Table, > 6 Feet
5. C - Seasonal High Water Table, 1.5 Feet - 3.5 Feet
6. C - Seasonal High Water Table, 0 - 1.5 Feet
7. D - Seasonal High Water Table, 0 - 1.5 Feet
8. Variable or No Data (includes urban paved areas)

There were several soil types identified within the Pascoag WHPA. Soil types identified in the immediate area of the wells include the Windsor loamy sand, 0 to 3 percent slopes (WgA) west of the wells; Merrimac sandy loam (MmA) south of the wellfield; pits and gravel pits (Pg); and Hinckley gravelly sandy loam, rolling (HkC) surrounding the wells; and the Adrian Muck (Aa) just southwest of Well #3. To the Southwest are large areas of the Canton Urban Lands Complex and the Canton Urban Lands (very rocky). Other soil types are present only in small amounts.

Soil Category	Chart Color	Area (sq. ft.)	Percent of Total
0. Variable or No Data		450,576	6.5%
1. A- Excessively Permeable		1,458,382	21.1%
2. B- Well Drained		4,732,321	68.4%
3. B- SHWT 1.5'-3.5'		-	0.0%
4. C- SHWT > 6'		-	0.0%
5. C- SHWT 1.5'-3.5'		-	0.0%
6. C- SHWT 0-1.5'		250,023	3.6%
7. D- SHWT 0-1.5'		26,078	0.4%
Total		6,917,380	100.0%



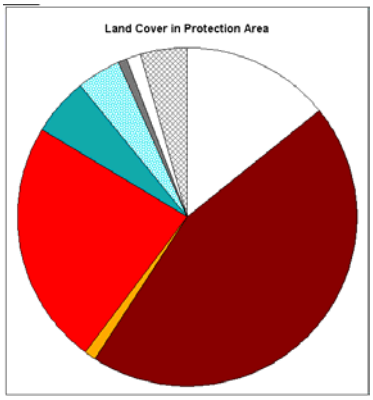
II. Susceptibility: Land Use and Potential Sources of Contamination

Two types of potential sources of contamination are used in this assessment. "Land Use" includes areas of land in a particular type of development or use, such as agriculture, residential housing, parks and recreational areas, etc. The coding is explained in the Land Cover appendix. "Facilities" are operations that are represented as points, have a street address, and usually have a single person or group in charge. These include businesses, factories, office buildings, hospitals, etc. Certain kinds of potential contaminants are associated with each kind of land use or facility. The assigned risk values for each type of facility are listed in the PSOC appedix.

LAND USE and ZONING (see Land Use map): A large portion of the WHPA consists of the "older" densely developed Pascoag Central Business District (CBD) (Land Use Codes 111 through 170) . Most of the stores/ shops in the area are relatively innocuous in terms of their risk to local groundwater resources. Dense, light commercial development, dense single-family, duplex, and multi-family residential development, a school, churches, a cemetery, a medical facility, a home for the elderly, a print shop, and automotive repair and filling stations were the predominant land uses in the area. Streets included in the land use inventory were: Route 107, Elm Street, Spring

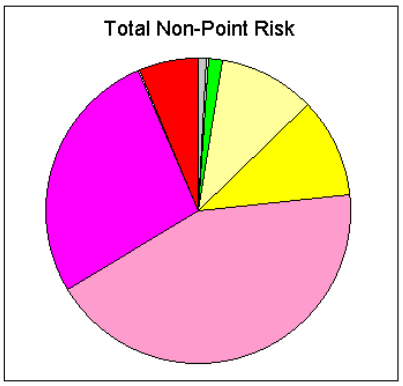
Street, Main Street, South Main Street, North Main Street, Summer Street, Shea Lane, Silver Lake Avenue, Grove Street, Sayles Road, Howard Street, Pine Street, Bridge Way, Irving Avenue, Rock Avenue, Church Street, Broad Street, Park Place, and Eagle Peak Road. Most if not all of the WHPA is sewered. "This sewer system is not a combined system, therefore all surface run-off ends up in the WHPA." (Pascoag Fire District Water Quality Protection Plan Update, April 1996.) Information describing some of the more noteworthy land uses located within the WHPA is provided in the attached table.

Anderson III	Chart Color	Area, sq. ft.	Percent of SWPA
No Data		978,112	14.1%
Moderate - High Density Residential		3,108,758	44.9%
Low - Moderate Density Residential		78,785	1.1%
Low Density Residential		-	0.0%
Commercial, Industrial, Mixed Urban		1,625,730	23.5%
Roads, Airports, Railroads		-	0.0%
Waste Disposal, Junkyards		-	0.0%
Institutional		373,314	5.4%
Pasture, Hay Fields, Idle Agriculture		-	0.0%
Orchards, Nurseries		-	0.0%
Cropland, Intense Agriculture		-	0.0%
Wetlands		296,870	4.3%
Beaches, Sandy Areas		-	0.0%
Quarries, Rocky Outcrops		56,240	0.8%
Water & Sewer Facilities		-	0.0%
Developed Recreation		-	0.0%
Urban Open Space		86,255	1.2%
Cemeteries		313,315	4.5%
Transitional Areas		-	0.0%
Total, Sq. Ft.		6,917,380	100.0%



Total Risk (see map): The "total risk" for non-point sources of contamination indicated below is calculated by adding the "soil" risk factor(1 – 4) to the "land use" risk factor (0 – 3). The higher number indicates a higher total risk.

Total Risk	Chart Color	Area (sq. ft.)	Percent
0: Not Rated		53,759	0.8%
1: Very Low Risk		26,078	0.4%
2: Low Risk		83,552	1.2%
3: Low - Moderate Risk		729,486	10.5%
4: Moderate Risk		719,483	10.4%
5: Moderate - High Risk		2,987,145	43.2%
6: High Risk		1,884,181	27.2%
7: Very High Risk		433,696	6.3%
Total Land Area (sq. ft.)		6,917,380	100.0%



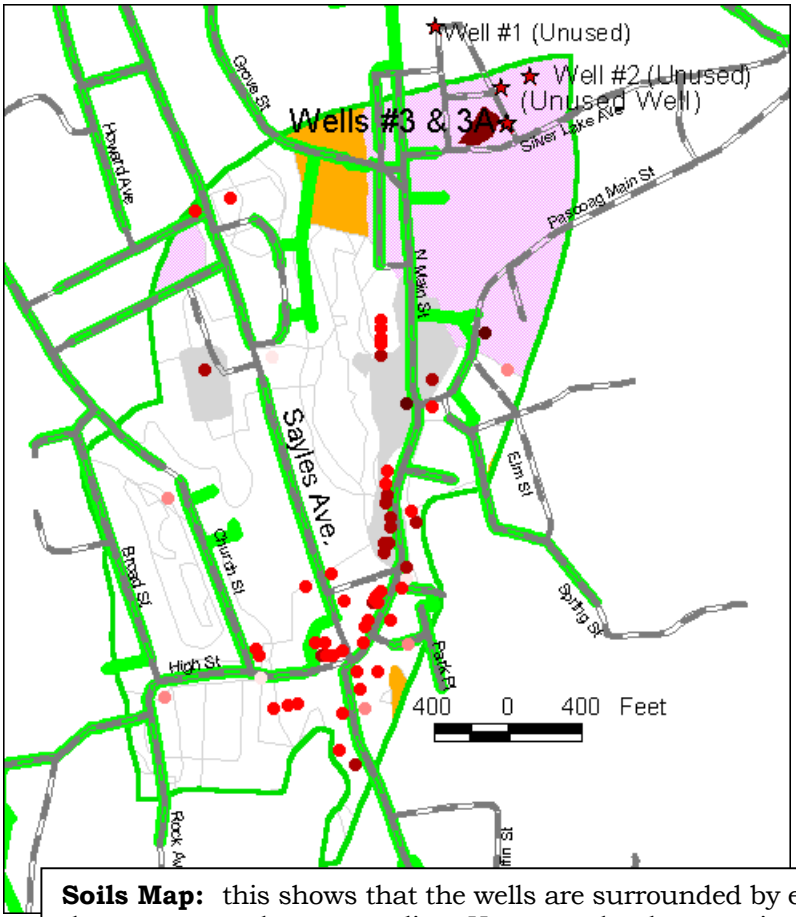
A total risk of zero represents slivers of polygons that have no values associated. As can be seen in the table, most of the land area is in moderate to high risk land use and soil type. Since most of this area is sewered, the primary risk in these areas is from accidental spills and stormwater carrying contaminants to the aquifer.

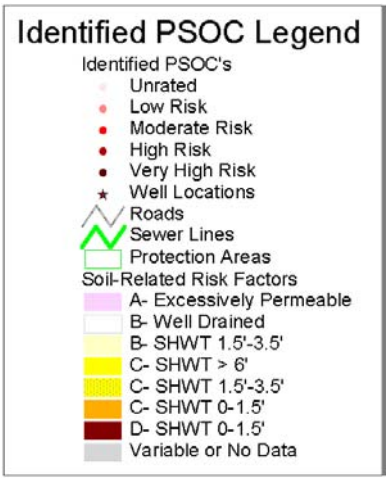
Individual Potential Sources of Contamination (PSOCs): The Protection Area is highly developed in both commercial and residential land use. The risk from each is determined by the type of business and the soil type on which it is located. Since the entire commercial area is sewered, the risk is primarily related to the possibility of accidental spills.

Individual business were identified throughout the protection area. (The "DEMID" indicates the presence of an Underground Storage Tank (UST) at the facility.) Those that use "Best Management Practices" may in fact present a lower risk to the water supply than that indicate in the table. As can be seen from the map below, all PSOCs are within sewered areas.

Facility Name	DEMID	Number	Street	Total Risk
North Main Auto Mobile Station	692	24	North Main Street	7
Val Mart Oil Service/Gas	844	253	Main Street	7
Always Automotive	0	91	South Main Street	6
Animal Expressions	0			6
Bradford Court	0	45	North Main Street	6
Byfield School	1164		High & Church Sts.	6
Computer Works	0	130	Main Street	6
Cumberland Farms	17041	138	Main Street	6
Donald E. Bailey, Jr. Accountant	0	164	Main Street	6
DP Printing	0	130	Main Street	6
Father Holland School	0		Sayles Avenue	6
Frances Moroney	15561	148	Main Street	6
Olympia Pizza	0	140	Main Street	6
Palmisciano's TV Repair	0	71	Main Street	6
Pascoag Caf,	0	80	Main Street	6
Pascoag Fire Department Station	0		Main Street	6
RI State Employees Credit Union	0	60	North Main Street	6
Ron's Wells & Pumps	0	86	Main Street	6
St. Joseph's Rectory	1980	183	Sayles Avenue	6
The Rose and Thistle	0	134	Main Street	6
Bargain Buyer	0	199	Main Street	5
Best In Donuts	0	20	High Street	5
Boucher Funeral Home	0	272	Sayles Avenue	5
Brigido's IGA Market	0		Sayles Avenue	5
Burrillville Police Community Center	0	92	Main Street	5
Champ's Liquors	0	16	South Main Street	5
China Star Restaurant	0	18	High Street	5
Chum's Hardware	0	66	Main Street	5
Crown Furniture	0		Main Street	5
CVS Pharmacy	0	20	High Street	5
DeWolfe Realtors	0	66	North Main Street	5
Diamond Video	0	48	Main Street	5
Elite Pizza	0	68	North Main Street	5
Fishin' Stuff	0	70	Main Street	5
Fleet Bank	1373		Fountain Square	5
Furry Friends	0	50	Main Street	5
George's Pizza	0	60	Main Street	5
Grandma's Attic	0	42	High Street	5
Hometown Barber Shop	17050	45	South Main Street	5
Imagine This Day Spa	0	9	Church Street	5
Lorraine's Salon	0	90	Main Street	5
Mad Dog Saloon	0	98	Main Street	5

Facility Name	DEMID	Number	Street	Total Risk
Moonshine Liquors	18353	145	Main Street	5
Mrs. T's Rental	0	168	Main Street	5
Nine Lives Thrift Shop	0	24	Sayles Avenue	5
North Mane Ltd.	0		North Main Street	5
Northern RI Uniforms	0	38	Main Street	5
Northwest Community Health Cent	3663		The Bridgeway	5
Pascoag Fire District Office	0	55	South Main Street	5
Pascoag Grammar School	2770		Sayles Avenue	5
Pascoag Post Office	1819		The Bridgeway	5
Pascoag Tanning & Cruise	0	88	Main Street	5
Plaza Diner	0		Merchants Square	5
R & G Value Outlet	0	170	Main Street	5
S & R Flooring	0	75	Main Street	5
Simpsom & Young Insurance Co.	0	9	Church Street	5
W. W. Logee Insurance Agency	0	65	Main Street	5
Bell Atlantic	1203	33	Park Place	4
Overlook Nursing Home	3737	14	Rock Avenue	4
Pascoag Auto Parts	15461	26	South Main Street	4
Pascoag Fire District Electric	0		Elm Street	4
Waterman-Brown Funeral Home	0	105	Church Street	4





Soils Map: this shows that the wells are surrounded by excessively permeable soils that could threaten ground-water quality. However, development in the area is served by municipal sewers.

The grey areas, indicating "variable or no data", are mostly areas covered entirely by buildings or pavement. These areas are sewered as well, but surface runoff from paved areas is discharged to groundwater.

USGS Vulnerability Study: (See Appendix) In 1999, the United States Geological Survey published a report entitled "A Vulnerability Assessment of Public-Supply Wells in Rhode Island" (Water-Resources Investigations report 99-4160.) A higher rank indicates a high susceptibility to contamination. Based on this analysis, Pascoag's wells had the following rankings:

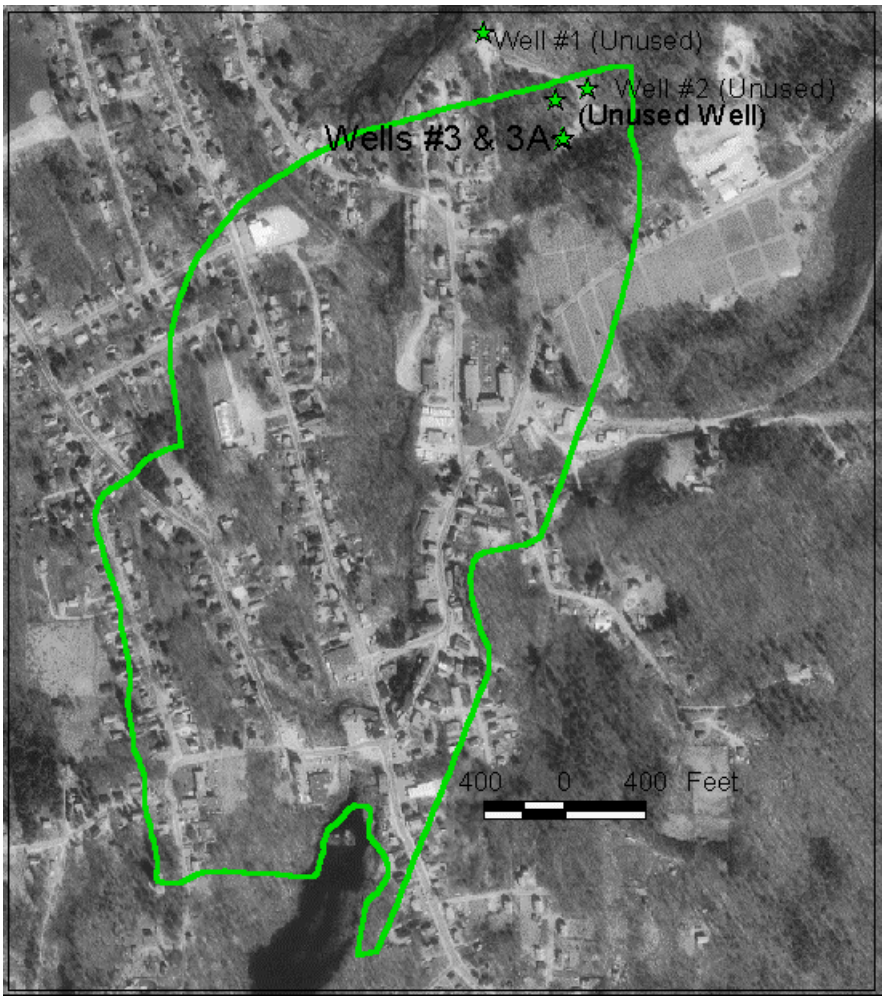
Plant Name:	**PASCOAG FIRE DISTRICT**
Source Name:	**WELL #3**
Nutrients	4
Solvents	4
Pesticides	4
Road-Deicing Chemicals	4
Fluoride	3
Radionuclides	2
Sum of Ranks	21

4: High Risk
3: Moderate Risk
2: Low Risk
1: Very Low Risk

A susceptibility rank of 21 puts Pascoag's water supply in the High Risk category for Rhode Island's wells.

IV. Maps and Tables

1. 1:12000 Digital Orthophotograph



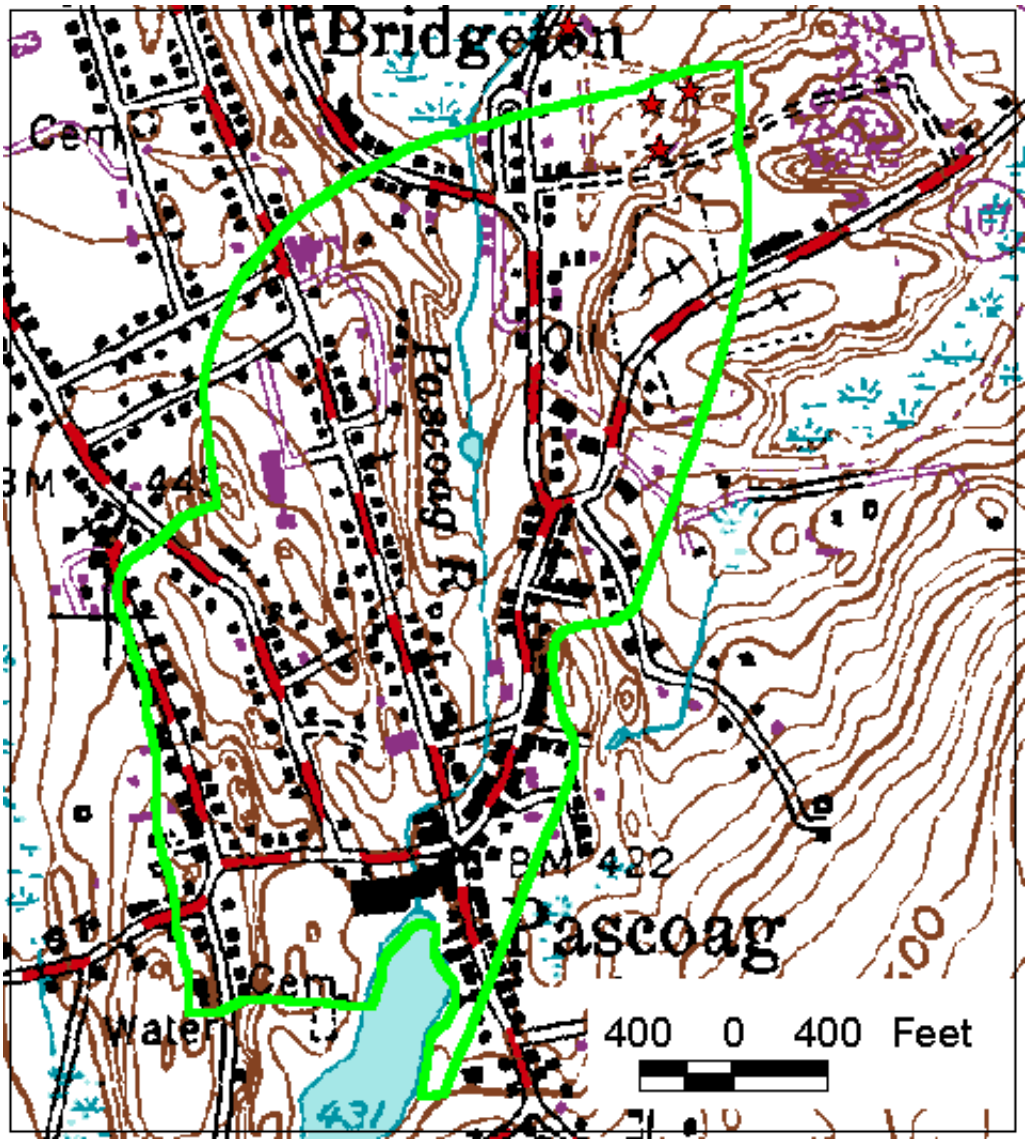
Legend

Corrected Well Location

Protection Areas

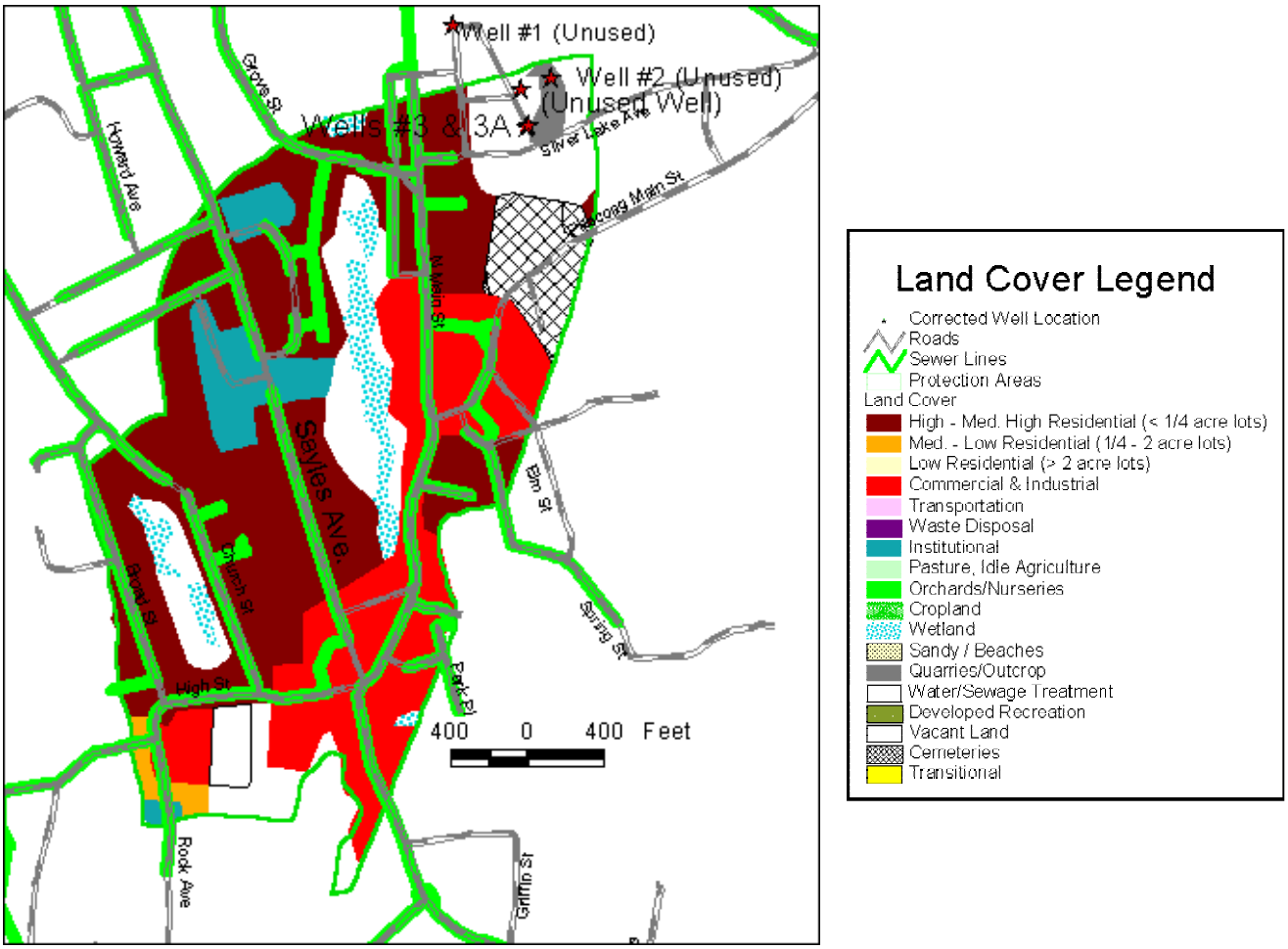
This is an aerial photograph of the Pascoag Source Water Protection Area (SWPA) taken at a scale of 1:12000 in March of 1995. The land cover data is based on this photograph. The green line shows the boundary of the recharge area, as drawn by DEM hydrologists under the Wellhead Protection Program. The wells are in the upper right-hand corner of the photograph; well #1 (no longer in use) is just outside the picture on the upper edge.

2. USGS Topographic Map



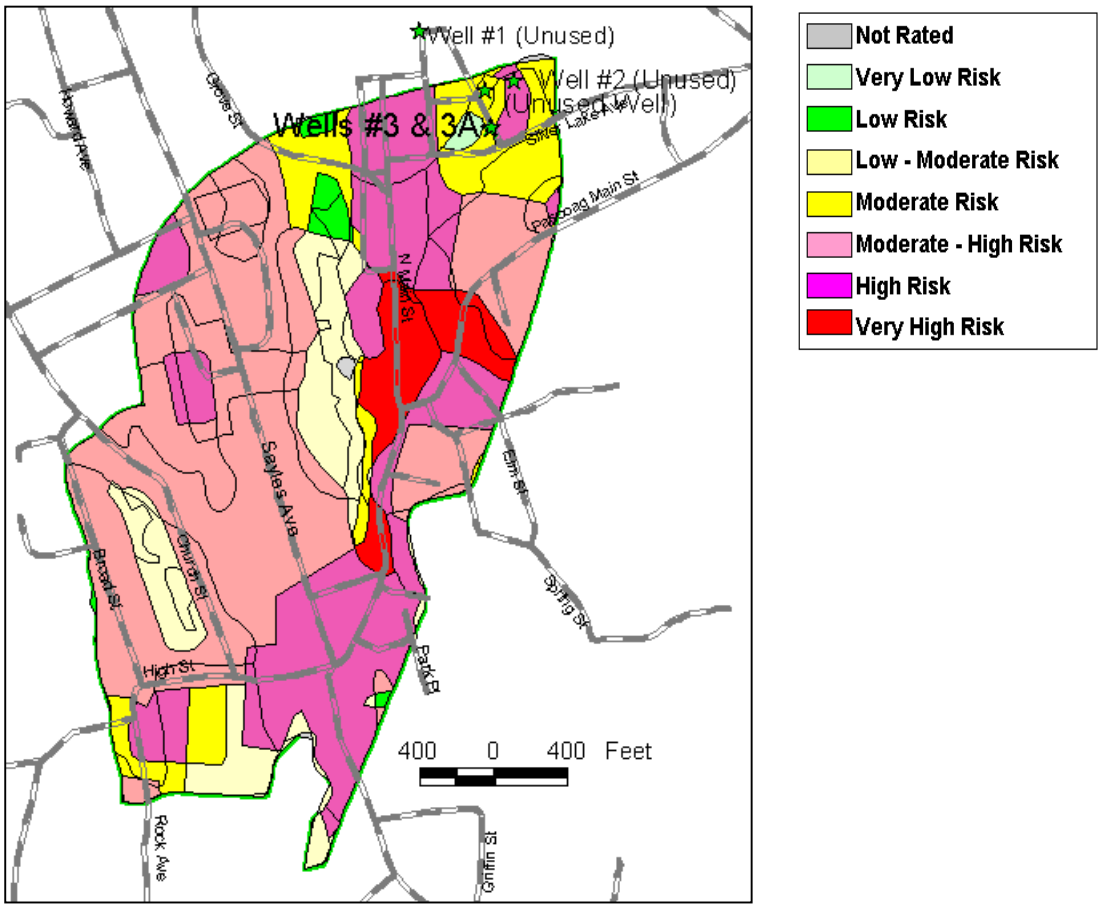
This is a section of the Chepachet quadrangle US Geological Survey topographic map. It shows the location of surface water, wetlands, roads, and buildings, in addition to the topography (land form). For a complete legend of topographic mapping symbols, see USGS's website at http://mapping.usgs.gov/mac/isb/pubs/booklets/symbols/

3. Land Cover



This map shows the highly developed nature of the Protection Area, and the extent of the municipal sewage system. The grey area immediately south of Well #2 is an inactive sand and gravel quarry owned by the Pascoag Water and Fire District.

4. Total NPS Risk



This map combines soil characteristics with land cover to highlight potential problem areas. (The high-risk pink immediately around Well #2 is related to soil type and past sand and gravel operations.) The red area identified as "very high risk" is comercially developed, and should be the focus of education and protection efforts.

IV. SUMMARY

According to the USGS Vulnerability Study, Pascoag's wells were determined to be highly susceptible to contamination, because of soil types and intensive development in the protection area. This is consistent with the findings of the Source Water Assessment by RI HEALTH. The sampling history to date does not show a contamination problem, but monitoring should continue for those SOC's not waived in 1996 (Di(ethylhexyl)phthalate (Phase V, TO25) and PCBs (Phase II, PE18)) (See waiver information above).